THE VETERINARY JOURNAL

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Vol. 104 June, 1948 No. 6

EDITORIAL

VETERINARY RESEARCH

RESEARCHES are progressing in this and other countries on some of the major problems of health and diseases of livestock. Times have changed so much that it is now rare to read the current number of any of the various journals without finding articles of interest and fundamental importance. It is also gratifying to observe that research work is being undertaken to an increasing extent in some countries in which contributions in the past have been somewhat few. We are happy to publish articles from such countries and so to assist in the general dissemination of knowledge, all of which is leading to a clearer and better understanding of the health and control of disease in animals. It is evident, for example, that workers in Egypt are producing results, following their inquiries along research lines, of much importance in that country: we continue to receive evidence of this from the articles published in this and other journals. There is no doubt that the basis of methods of disease control lies in the results obtained from careful research work and, although methods of disease control may form a similar general pattern in all parts of the world, special attention has to be given to local conditions and the methods varied accordingly. It is, therefore, very satisfactory to note the interest taken by the various countries in the results of research work in general and the differences shown by the various workers between these general findings and those observed in their own countries. We welcome such contributions and hope that their publication will stimulate the workers to continue their efforts in arriving at a better understanding of methods of maintenance of health and control of disease in all classes of animals in the different parts of the world.

Veterinary research work has cleared up many points in our knowledge of disease processes and, as it progresses, will continue to do so. Subjects on which our understanding and information were vague are now being more clearly appreciated and links are being forged in the chain which is binding together our appreciation of what really happens in the animal body when abnormal conditions arise. It is true, of course, that many of the observations made by workers in the past were sound: with newer knowledge and its application we realise the value of such

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observations and we are gradually finding explanations for them. So-called fundamental research is of the greatest possible value in all aspects of science and must be fostered and continued to the fullest extent. Research workers with the necessary outlook for such work must be encouraged by all possible means to pursue this type of study, for it is largely as a result of their work that we evolve the methods we apply in the field in keeping the health of our animals in a state necessary to obtain the best productive results. It is indeed gratifying to read of the awards of funds for this purpose and to know that such encouragement is being given throughout the world.

The further work on this application of results of basic or fundamental research often concerns another type of worker, although no hard and fast line must ever be drawn between those who, by careful study, discover and those who apply these discoveries : they often go hand-in-hand. Generally speaking, however, the evolving of methods of health and disease control and their application in the field requires training which the basic or fundamental research worker may not possess. It is in this aspect of the work that veterinarians have such a large part to play in problems affecting livestock and other animals. It does not follow, of course, that the person trained in veterinary work may not engage in fundamental work : far from it, in some respects such persons are admirably suited for such work, but in the application of the results of basic findings to problems concerned with livestock a veterinary training is of the greatest importance. It is interesting to observe the trend of research work to-day in livestock matters, embracing as it does some fundamentals with the bias upon their application. We need workers in all branches of science in order to obtain the clearest picture of the causation of disease in animals and in the application of control measures to ensure the economic use of the stock throughout the world. We, veterinarians, have to link up with workers in the various branches of science, train, if necessary, some of our personnel in other aspects of science, and by a joint effort come to a better understanding of health and disease, the ultimate object being the control of animal health to the greatest extent.

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GENERAL ARTICLES

DISEASES THAT AFFECT MEAT PRODUCTION

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By meat-producing animals we usually mean, in this country, oxen, sheep, pigs, poultry and, to a limited extent, rabbits. During the war the practice of eating horse meat developed, and latterly, whale meat has been made available. I shall not refer to the diseases of horses, rabbits and whales, as these animals are not farmed for meat production to any extent, as yet, in this country. Neither shall I dilate on the disease of meat-producing animals overseas, for their problems are not the same as ours.

Quality, Quantity and Demand Affected

As meat-producing animals are kept basically for profit, factors which reduce the economic return to the farmer are important. Most animals that are kept for meat production are brought to their prime as early as possible, and so their lives are usually shorter than those of animals of the same species kept for other purposes. Furthermore, they are generally more out in the open, on free range. These conditions are favourable to the avoidance of many of the insidious diseases. Nevertheless, disease is one of the greatest liabilities of the meat producer, for it not only reduces the potential quantity of meat that can be produced but it also seriously affects its quality. Even if it does nothing else, illness almost invariably prevents an animal from putting on weight rapidly and so increases the cost of meat production.

A third effect of disease is that the knowledge of its existence in the meat-producing animals, particularly in those countries where an efficient system of meat inspection is not in vogue, tends to reduce the consumer demand for it. This is particularly so when some of those diseases of animals are present which are communicable to man. Clearly, then, it is to the advantage of all interested in meat —producer, purveyor and consumer—that diseases be eradicated if possible from our meat-producing livestock.

These diseases may be broadly separated into those which reduce the potential number of livestock, those which affect the young, and those which affect the adult animal.

In the first category must be included the many causes of infertility which prevent the young from being born, as well as the highly infectious and catastrophic diseases which spread rapidly throughout herds or flocks, and result in the death or slaughter of a high proportion of the animals.

Appalling Toll of Infertility

Dealing first with infertility, the incidence of this trouble is lower in those

Lecture delivered to the Institute of Meat, Monday, March 15, 1948, at 5 p.m.

animals which have free range of pastures or hills than is found in animals that are more intensively produced and housed. Whereas about 30 per cent. of our dairy cows are estimated to be infertile at any one time, this figure is much lower with the true meat cattle. But even in these herds it varies tremendously. Sometimes it may be practically absent from a herd, whilst in another it may be present to the extent of about 90 per cent. By and large, however, in the true beef-rearing herds the incidence of infertility is probably present to the extent of about 5 per cent., whereas 20 per cent. is more like the average in those herds which supply calves to the meat-raising herds. Before the war there were approximately five million beef cattle as opposed to three million dairy cattle, and the loss of potential calves from the million cows of the beef herd would be in the region of 12,500 per annum on the conservative estimate of 5 per cent. infertility. Estimating the value of these calves at only 50s. each, this would mean a monetary loss of over £30,000. But the calf loss of the dairy herd is also a loss of potential veal, and infertility in the dairy cow results in the under-production of 240,000 calves every year. If these calves had been born and sold as veal, the gain to the producer would have been in the region of £600,000. That is, the total loss of calves owing to sterility costs the nation more than £630,000 per annum. Reckoned in terms of veal and taking a low average weight of 60 lb. per calf, the total weight of meat lost is 15,150,000 lb. weight. Expressed in terms of the present-day ration of 1s. 2d. per week, or 61s. a year, infertility of cattle results in the loss of veal which would more than meet the official yearly allowance of 210,000 people.

Contagious and other forms of abortion also materially reduce the number of calves born. It was estimated by the National Veterinary Medical Association that 320,000 dairy cows abort annually at a cost to the nation, due solely to the loss of calves, of £800,000. This is equal to more than 266,000 annual rations lost. Thus, infertility and the various forms of abortion in our beef and dairy herds to-day are responsible for the under-production of calves to an extent which would have provided the consumer with veal equivalent to more than 476,000 full yearly rations of meat.

Infertility is not so prevalent, so far as is known, in our sheep flocks, but according to the estimate of the National Veterinary Medical Association enzootic abortion in sheep alone costs the nation £110,600, or more than 36,800 yearly rations of lamb. The best estimate of the extent of infertility in swine is about 30 per cent. and the number of still-born about 5 per cent., and hence considerable loss of pig meat must result from these ailments, although no reliable estimate of it is available. It was, however, estimated in 1942 that the annual loss from swine abortion in the United States cost that country 10,000,000 dollars. Infertility in terms of egg hatchability is known to be a cause of great loss to the poultry industry, but I will refer to disease in poultry later on.

The Killing Diseases

Other diseases which cause considerable loss of meat are the notifiable diseases, such as cattle plague, foot-and-mouth disease and swine fever, which result in the loss of mature animals, either by death or by slaughter.

Cattle plague is one of several diseases which decimate infected herds and which have, fortunately, been eradicated from this country. It is still present in Eastern Europe, on the continent of Africa and in Asia, and it has a high mortality rate. A short while ago Sir John Boyd-Orr stated that if cattle plague could be eradicated from the world, this alone would result in an increased production of meat which would ensure that the whole of the world had adequate meat food.

In Great Britain, the only disease of this character which still, at times, affects our cattle is foot-and-mouth disease. The extent of the losses arising from this disease varies from year to year, but in 1937, a reasonably average year, 31,586 cattle were slaughtered.

Swine fever is another disease which results in heavy mortality if not actually checked by the slaughter policy. In 1937, the number of pigs slaughtered from this disease was 2,033.

These catastrophic diseases at times cause very serious losses even in this country, as is instanced by the recent outbreak of fowl pest, which resulted in the slaughter of over 200,000 poultry and probably the death or private slaughter of at least an equal number. This illustrates how fortunate we are in this country to have a veterinary service which has kept the major killing diseases, save for odd outbreaks, out of the country for the last 60 years. I will make no estimate of the meat loss from these diseases, but it must be considerable in Great Britain even to-day.

Diseases of the Young

Diseases of young stock take a heavy toll in all our breeds of animals and, by and large, it can be said that we know less about these diseases than about any other major group. It is, indeed, one of the lines of investigation which the Animal Health Trust hopes actively to foster at its new research stations.

It has been estimated by the National Veterinary Medical Association that one calf out of every 18 born, excluding still-births and abortions, fails to reach maturity. Further meat loss, of course, results from the fact that many more become stunted and unthrifty. The major troubles of young calves are white scour, navel ill and joint ill, each of which causes very heavy loss. Older calves suffer from rickets, calf diphtheria, Salmonella infections, calf pneumonia, and blackleg. Tuberculosis, from abattoir figures, appears to affect even very young calves to the extent of 1-2 per cent. In addition, there is heavy loss in calves from parasitic diseases, particularly round worms and liver fluke. Unfortunately, I have not time to dilate on these conditions at length.

With a total cattle population of 9,000,000, we can consider there are at least 2,000,000 calves born a year. A loss of one out of every 18 of these means a loss of over 500,000 calves. This, in terms of value, keeping our figure conservatively at 50s. a calf, means a monetary loss of £1,250,000 a year, the equivalent of about 433,000 annual meat rations, as veal.

Much of the loss in calves from disease can be reduced by the adoption of proper methods of calf husbandry and rearing, but even so there is still room for

considerably increased knowledge to enable us to prevent and to treat these diseases more effectively.

There are many diseases that affect lambs. Most important of these is lamb dysentry, but recent research into this condition has given us a method of prevention which is now so widely practised that the losses have been reduced to comparatively small dimensions. This is an indication of the value of research. In the recent survey of sheep diseases made by the National Veterinary Medical Association, they estimated the following annual losses from various lamb diseases: pulpy kidney disease, £208,700; entero-toxæmia, £110,600; louping ill, £38,000; joint ill, £25,400; braxy, £20,000; swayback, £10,900.

If we include the loss of £93,000 already referred to as arising from enzootic abortion, we have a total monetary loss arising from disease in lambs of £506,600 per annum. This loss is equivalent to over 168,000 annual rations of meat, as lamb.

The heaviest losses with pigs occur in the rearing period. Here, again, much further investigation needs to be done upon the causes of these losses before they can be effectively brought under control. It has been estimated that in the year 1937-38, when there were 450,000 sows, 1,800,000 " suckers " and 900,000 weaned pigs died, resulting in a monetary loss of £5,400,000. This loss is equivalent to 1,800,000 annual meat rations, as pork or bacon. This loss is, of course, less to-day with our smaller pig herd.

Thus, disease conditions in the young result in the loss of more than 250,000 annual rations of veal, 168,000 annual rations of lamb, and 1,800,000 annual rations of pork. That is a total annual loss of meat rations for over 2,000,000 persons for the whole year from disease in young farm livestock.

Diseases of Mature Animals

The important diseases of mature beef-producing animals differ somewhat from those affecting dairy cattle. The incidence of disease in beef-rearing herds is low, but in the beef-raising herds—that is, those herds dependent upon calves bought from markets—it may be very high, particularly in calves. Mastitis and contagious bovine abortion are relatively unimportant, although the latter may be high in certain herds. Tuberculosis is not so prevalent, as a rule, in beef herds. Its incidence in heifers and bullocks has been rated at 5-6 per cent., as judged by abattoir investigations. Meat condemned from this disease at abattoirs has been estimated at a loss of £300,000 per annum, which is equivalent to 100,000 annual meat rations. A Government Committee in considering the effect of tuberculosis on the nation's herd of cattle and taking into account both the loss of meat and the need for replacing affected animals, put the monetary annual loss at £3,000,000. Clearly, 100,000 annual rations of meat is an under-estimate of the loss of meat arising from tuberculosis in cattle.

The greatest worry of beef herds is probably parasitic diseases. Parasitic gastro-enteritis (which may be caused by one of several worms) and parasitic bronchitis, husk or hoose are common and usually give rise to much loss of condition and emaciation. The effects of these diseases can be reduced considerably by careful pasture management, adequate feeding, avoidance of overcrowding, and

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the protective use of suitable drugs. Redwater is a parasitic disease of cattle in certain areas of the country and is probably more important than is realised, while certain external parasites, such as lice, warble flies, mange mites, ringworm and ticks may lead to considerable loss of flesh.

It is not possible to give an accurate estimate of the loss from these parasitic diseases, as comparatively few of the animals actually die, although the rate at which they put on flesh is generally slowed down and sometimes reversed, and hence the loss of meat can be considerable. An estimate has been made of the effect of warble fly which, as you know, is another affliction that prevents beef cattle from putting on flesh. In the year 1943, 43 per cent. of the ox hides and 24 per cent. of the cow hides were warbled, resulting in a financial loss of hides valued at £750,000. This loss must be borne ultimately by the producer and the meat trade. The carcasses or "licked beef" from warbled animals too often need considerable trimming before they can be saleable as meat. Liver fluke can also cause considerable loss in adult beef cattle, as well as in calves. An extensive abattoir survey showed that 17.7 per cent. of cattle were affected with liver fluke and that 14.6 per cent. of these were steers. It was estimated that there was a loss to the meat industry of 1,500 tons of liver per annum, which, at 1s. 2d. per lb., meant a loss of £200,000.

Another major loss with beef cattle arises from various metabolic and feeding troubles. Hypomagnesæmia, milk fever, acetonæmia, blown or hoven, and various forms of indigestion are not uncommon in beef cattle, and can cause considerable losses. Most of these ailments appear to arise from errors in feeding, and many would seem to be connected with the management of pastures and the feeding of dried grass. This whole group of diseases needs much more intensive research, and it will form an important part of the work of our Cattle Research Station, when this is established.

Johne's disease is exceedingly important in certain beef-producing areas, as, indeed, is blackleg and, to a lesser extent, anthrax. A not uncommon trouble in cattle kept in courts is traumatic pericarditis. Actinomycosis, or lumpy jaw, is also fairly prevalent amongst beef cattle. All these diseases result in the under-production of beef.

Approximately 50 per cent. of home-produced beef comes from dairy cattle, however, and hence these animals should not be disregarded in our consideration. I do not intend to dilate on the diseases of our dairy herd, save for the previous reference to infertility, but they must result in considerable loss of beef.

Parasitic gastro-enteritis is also common in sheep, and the monetary loss arising from it is estimated at £348,000 per annum. Pregnancy toxæmia accounts for another £119,000 loss, and scrapie a further loss of £36,000 annually. Other heavy losses which have not been estimated arise from blow-fly infestation, foot rot and liver fluke. When we consider only the diseases for which we have estimated losses, then the monetary loss arising from diseases in adult sheep amount to £503,000. This is equivalent to 167,000 annual meat rations, as mutton.

Further heavy losses are suffered in adult pigs from swine erysipelas, swine fever and paratyphoid infection. Much of these losses can be avoided to-day, for

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both swine fever and swine erysipelas can be prevented by suitable vaccination at the right time. In 1937, 2,033 pigs were slaughtered from swine fever and 1,700 from swine erysipelas, giving a total loss of 3,733 pigs. If we assume the average weight of the pigs lost was 100 lb. and that their price was £1 per score, the monetary value of this loss is £18,665. Further extensive loss arises from paratyphoid fever, which lowers condition and only slowly permits weight increase to regain its normal acceleration. There are many other conditions which affect adult pigs, but I cannot deal with these now. Assuming that the number of annual meat rations lost from disease in adult pigs to be due solely to swine fever and swine erysipelas, we are certainly under-estimating the true loss. Nevertheless, this gives us the figure of more than 6,100 annual rations of pork.

Disease in Poultry

It is safe to say that in no other branch of agriculture has disease taken such a high toll as in poultry farming. The wastage from disease was so great pre-war that in 1936 a Commission was set up to investigate the problem. This committee estimated that in an industry with an annual value of £30,000,000, the loss from disease was in the region of £4,000,000.

Figures available from egg-laying trials and taken over a 12-year period showed that the mortality of these trials approximated to 20 per cent. That is, of specially selected birds well managed under control conditions, one in every five died before the end of its first laying year. This figure was probably lower than that occurring throughout the general flocks of the country. Economists reported that in surveys carried out in various parts of England and Wales, of every 100 eggs set less than 30 per cent. reached maturity.

At the present moment, the adult poultry stock in England and Wales is estimated to be 22,000,000 of a value of £5,000,000. The mortality at egg-laying trials since the war, although less than formerly, is still about 15 per cent. Using this as a guide to mortality throughout the country, the loss in adult birds is, therefore, about 7,000,000. Taking the average weight of a carcass at 4 lb. means that there has been a wastage of 12,500 tons of flesh. Similarly, the estimated egg production is at the moment 11,000,000 boxes, each box containing 360 eggs. Of a total output of 4,000,000,000 eggs, there is a potential loss from disease in egg production of 500,000,000, or the rations at present-day standard for at least 10,000,000 people. The losses would be more than three times as great if the number of poultry was as large as pre-war. Thus, normally, the country loses annually from disease in poultry at least 37,500 tons of poultry flesh and 1,500,000,000 eggs.

The causes of this wastage can be roughly divided into diseases of chicks and diseases of adult stock. Undoubtedly, the most serious losses in chick rearing are due to infections caused by organisms of the Salmonella group. In a recent survey it was shown that 30 per cent. of the chicks examined at the Ministry of Agriculture's laboratory over a 12-year period were affected with bacilliary white diarrhœa. It is difficult to put the exact figure of the losses caused by this disease, but at

commercial hatcheries alone it must be many thousands of pounds a year. Coccidiosis, nutritional deficiencies and mismanagement account for the greater bulk of the losses in rearing. The overall losses in chick diseases on the proportions already mentioned probably amount at least to £1,000,000 a year.

In adult stock, undoubtedly the most serious economic disease is fowl paralysis. This condition occurs in at least 30 per cent. of the specimens received at laboratories for examination, and probably causes an economic loss in the region of £1,000,000 per annum. Other serious infectious conditions which can completely decimate poultry flocks and which, in many cases, have caused their owner's bankruptcy, are fowl pox, tuberculosis, fowl typhoid and parasitism. In 1933, an outbreak of fowl cholera which occurred in East Anglia killed over 1½ million birds.

During 1947, this country experienced a severe outbreak of fowl pest. More than 1,000 outbreaks were diagnosed and the official figures for the number of birds slaughtered was over 200,000 and the compensation paid approximately £200,000. At least an equal number of birds died, so that nearly 2,000 tons of poultry meat were lost and the potential loss in egg yield was placed at 12,000,000 eggs—a heavy price to pay for the Ministry of Food's decision to import infected poultry carcasses from abroad.

Consumer's Angle

The consumer naturally is worried at the amount of disease in meat-producing flocks and herds, but his anxiety is increased still further when he realises that there are several diseases, such as tuberculosis, undulant fever, salmonellosis and trichonosis, which can be transmitted to human beings direct from animals. Naturally, the risk of human disease from meat is very largely prevented by proper cooking, although even then infections may be passed on to those who handle the raw meat. It is therefore highly desirable that an efficient system of meat inspection and control should be established.

In this country there is still much room for improvement before our meat inspection service is equal to that prevailing in many other advanced countries.

To-day, the consumer is alive to the need for more meat and consequently he is justly concerned at the huge wastage of potential meat as the result of disease in our farm livestock. In this paper I have referred to the many diseases which lower meat production in Great Britain, and I have in certain instances translated losses based on fair estimates into annual meat rations. Clearly much loss is omitted from these estimates, but, even so, I have indicated that there is an annual loss of meat in excess of that required to provide full meat rations for 3,000,000 people. The total loss is certainly not less than double this—namely, full rations for more than 6,000,000 persons each year. In addition, there is a loss of at least 1,500 tons of liver from fluke infestation alone and more than 37,500 tons of poultry meat from disease. Can we afford to neglect to take steps to reduce these losses in our present drive to feed ourselves?

The annual economic loss to the country and the meat lost expressed in terms

of the present-day ration from those diseases of which there are reliable estimates are shown in the accompanying table:—

Animal	*Disease*	*Financial Loss* £	*Rations Lost*
Cattle	Infertility	630,000 ...	210,000
	Abortion	800,000 ...	266,000
	Diseases of Young ...	1,250,000 ...	433,000
	T.B.	300,000 ...	100,000
	Parasitism*	950,000 ...	—
Sheep	Abortion	110,600 ...	36,800
	Diseases of Young ...	506,600 ...	168,000
	Adult	503,000 ...	167,000
Pigs	Diseases of Young ...	5,400,000 ...	1,800,000
	Adult	18,660 ...	6,100
Poultry	All causes*	4,000,000 ...	—
		£14,568,860 ...	3,286,900

* There is an additional loss of liver 1,500 tons and of poultry meat 37,500 tons, and of 1,500,000,000 eggs.

Future Action

From what I have said, it is more than evident that the loss arising from disease in our meat-producing animals is serious. I have indicated that certain of these diseases can be effectively controlled if the farmer and the veterinary surgeon co-operate more effectively. Regular veterinary advice and attention to beef and swine herds and sheep and poultry flocks would give excellent results even to-day. A point of importance which would result from this campaign would be the culling of animals that are inefficient producers because of disease. In this way the limited supplies of fodder at present available would be much more efficiently used. It becomes even more necessary to develop this campaign as the plan to increase beef cattle, pigs and poultry to pre-war numbers gets under way. It is said that the veterinary man-power position precludes this, but in actual fact, apart from the shortage of veterinary surgeons within the Animal Health Division of the Ministry of Agriculture—a shortage due to reasons which could soon be remedied by the authorities if they wished—it is thought by many of the profession that there are sufficient veterinary surgeons in the country to justify the commencement of an extensive disease control plan. As the campaign develops, so will more and more veterinary surgeons become available.

Another important deficiency is that at present there is insufficient research being conducted into the diseases of meat-producing farm livestock. Much more research requires to be done, and in this important task I hope the Animal Health Trust, although an independent body relying upon voluntary funds, will be able to assist as its group of research stations develops.

Finally, a nationally co-ordinated abattoir service with meat inspection carried

out under adequate veterinary supervision would secure great benefits to producer, purveyor and consumer, and would also provide invaluable information to those who are striving to bring about the control of disease upon the farm.

Summary

(1) Disease causes an annual loss of meat in excess of that required to provide full meat rations for 3,000,000 people, and the total loss is certainly not less than double this amount.

(2) In addition, there is a loss of at least 1,500 tons of liver from liver fluke, of 37,500 tons of poultry meat and of 1,500,000,000 eggs.

(3) The major cause of loss in meat production is infertility in both cattle and sheep (including sterility and the various forms of abortion); diseases of the young; tuberculosis in cattle; parasitic gastro-enteritis in cattle and sheep; Johne's disease; pregnancy toxæmia and scrapie in sheep; swine fever, erysipelas and paratyphoid infection in pigs; in poultry, B.W.D., salmonellosis, coccidiosis, fowl paralysis and fowl pest.

(4) The total economic loss to the country must be considerably greater than £14,000,000 annually, and this does not take into account the sums paid in compensation by the Government.

(5) The action to be taken to control these losses is discussed and suggestions made for nationally co-ordinated abattoir service, an extended disease control plan and increased research into the diseases of meat-producing farm livestock.

STUDIES ON THE ANATOMY OF THE OVARY AND CORPUS LUTEUM OF THE CAMEL

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Introduction

ALTHOUGH the ovary and corpus luteum of most domesticated animals has been fully described by many workers, little is known about the ovary and corpus luteum of the camel.

Lesbre (1903) compares the ovary of the camel to a pea or a nut. It is concealed in a sort of coppula of the broad ligament of the uterus.

He reports also the presence of numerous ovisacs on the surface of the ovary which gives it the appearance of a bunch of grapes. He reports the presence of the round ligament of the ovary in a well-defined manner.

Leese (1927) points out that the ovary is a somewhat flattened organ which measures one inch long.

Asdell (1946) gives the length of the graafian follicle of the camel about 1-1.5 cm., and when fully mature reaches about 2.5-3 cm.

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The object of the present work is to study the anatomy of the ovary and corpus luteum of the camel, both macroscopically and microscopically.

Material and Method

The ovaries described in this paper were obtained from the slaughter-houses of Cairo and Embaba. The ovaries of one hundred and fifty pregnant and non-pregnant Sudanese female camels between 3-5 years old were examined *in situ* and then afterwards removed for their description. On account of the resemblance of the corpus luteum of the camel to a laterally compressed sphere, two measurements were taken, one longitudinally, the other transversely, instead of the three-dimensional measurements of Hammond (1927) in the cow.

The ovary and corpus luteum were examined both macroscopically and microscopically.

No available literature on the relations between the length, weight, embryological differentiation and the age of the fœtus was found. In this present work, the length of the fœtus between the occiput and the root of the tail has been substituted for the age of the fœtus in describing the development in different corpora lutei. The average length of the newly-born calf was obtained by measuring the lengths of several newly-born Sudanese calves.

The Ovary

Morphology and Position.—The ovary presented itself as a somewhat reddish flattened lobulated organ with a circular outline (Plate I, Fig. 2). The lateral and medial surfaces were but slightly convex. The free ventral border was convex and presented no ovulation fossa. The corresponding attached border was somewhat straight. The ovary was enclosed in a large conical pocket-like fold of the mesosalpinx, known in the sow and bitch as the bursa ovarii. The apex of this bursa in the camel was blind and laterally situated. The corresponding medial end of the bursa formed a large circular orifice beyond which laterally the fimbriæ of the uterine tube were situated on the floor of this bursa. The ligament of the ovary was attached to the upper surface of the broad ligament close to its attachment to the lateral border of the cornu of the uterus. The ovarian ligament had been found in the form of a cord-like structure extending from the superior surface of the broad ligament to the well-defined hilus of the ovary of its own side (Plate III, Fig. 1). The point of its origin lay half-way between the lateral border of the cornu and the ovary itself.

On examination of the ovary *in situ* in several carcasses in the slaughter-house of Cairo, its position was at the level of the sixth or between this and the seventh lumbar vertebra and about 6-7 cm. in front of the crest of the ilium. This situation, however, was subject to a certain amount of variation, depending on the condition of the viscera in its vicinity. It is of a practical value to state that the ovary lay at a distance of about 18 inches from the external opening of the vulva.

In a mature animal, the ovary weighed 2-4 gm. and measured about 2-4 cm. long, 1.5-2 cm. wide and 0.8-1 cm. thick.

The Structure of the Ovary.—Sections through the ovary revealed that the

cortex of the organ was formed of lobules or graafian follicles embedded in a layer of connective tissue derived from the stroma of the organ. On section, the lobules showed round or triangular form and were arranged around the stroma in a layer of uniform thickness, about 2-4 mm. in depth. Superficially, the tunica albuginia surrounded the cortex; the latter was covering the organ except in the region of the hilus. The stroma of the organ was about 2-3 mm. in thickness. Numerous graafian follicles in various stages of development were present. The largest follicles measured about 17 and 15 mm. in longitudinal and transverse diameters, respectively. Young follicles were noticed to replace whole lobules and appeared on the surface of the organ as slight round elevations of 5 mm. in diameter. The clear translucent and piriform graafian follicles presented a spherical appearance when they had been dissected out of their sockets. The whole bulk of the larger follicles protruded over the ovary's surface and presented no stigmas on their own surfaces. The graafian follicles were situated on the free ventral border of the ovary, mostly on or near the poles. Some of these follicles had been noticed on the surface near the border, yet they had been growing tangentially towards the borders or the poles.

In comparing the ovary of the camel with that of other domesticated animals, it was noticed that the former showed close resemblance to that of the sow except in lobulation which is flattened in the camel and globular in the sow (Plate I, Fig. 2).

Microscopic Examination of the Ovary

The paraffin method was used.

Stains used: Hæmatoxylin eosin, Van Gieson's, Mallory's and orcein.

The ovary was surrounded by a mesothelial layer. The lobules were formed of epithelial cells. The stroma was formed of connective tissue and plain muscle fibres. The stroma was distributed in a fan-shape manner lining the cortical layers; the converging point of this fan-shape was towards the hilus.

Follicles.—In young ovaries, primary follicles of one or more layers were seen in abundance occupying the cortical layer of the free ventral border and the poles of the organ.

Graafian Follicles.—In young graafian follicles, the stratum granulosum was formed of about 4-5 layers of cells; their nuclei were deeply stained. The cells near the follicular cavity were polyhedral with rounded nuclei and clear unstained cytoplasm. Those in contact with the basal membrane were columnar with elongated nuclei filling nearly the whole cells. The long axis of the cells was directed towards the follicular cavity. The basal membrane was clearly visible. The theca interna consisted of 2-3 layers of round or oval cells with less stained nuclei and slightly stained cytoplasm. (The third layer usually was not well defined in this stage.) Capillaries were present. The theca externa was very thick. A well-developed smooth muscle layer was surrounding the follicle.

Moderately large follicle (*1 cm. above the surface of the ovary*).—Stratum granulosum: the cytoplasm of the cells clearly stained. The nuclei were vesiculated and rounded. Six to seven layers of cells were present. The columnar

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form of the cells near the basal membrane was maintained. The theca interna now presented three layers of epithilioid cells; numerous blood vessels were noticed near the basal membrane (Plate III, Fig. 2).

Large Follicles (*17 mm. long*).—Stratum granulosum composed of about 12-14 layers of cells nearly rounded and finely granulated; the nuclei were vesiculated and rounded. The theca interna was now about four layers of epithilioid cells, larger than those of the granulosa with large rounded and vesiculated nuclei. A layer of well-developed blood vessels on the limit between the granulosa and the theca interna was conspicuous.

The Corpus Luteum of the Camel

During Pregnancy.—The corpus luteum occupied an obvious position on the free ventral border of the ovary and protruded wholly from the organ. Only a narrow constricted zone from the ovarian stroma was noticed to be in continuation with the thecal capsule.

Examination of the corpus during the period of pregnancy revealed soft flappy consistency and spherical form. In a few specimens they were elongated or oval. The capsule consisted of the tunica albuginia of the ovary and the underlying thecal layer which retained its membranous appearance till the stage when the fœtus reached 20 cm. long. In later stage of pregnancy the thecal layer became whitish opaque concealing the colour of the lutein mass, so that the intact corpus appeared grey, bluish grey or whitish grey. The tunica albuginia was noticed to be strongly adherent to the underlying thecal layer and surrounding nearly the whole corpus, only separating from the latter at its point of attachment with the ovary forming a constriction or neck.

Longitudinal and transverse section of the corpus showed well-defined circular and oval contours, respectively. The lutein mass formed elongated conical lobules, of which the apices were attached to the central plug and the bases were visible in the young corpus as round elevations through the transparent capsule. In the youngest corpus the central plug was attached to an inverted part of the capsule, which was conically shaped, with the apex pointing to the centre of the corpus, and filled with clotted blood except a linear zone next to the surface which now became intact. In the older corpora the central plug appeared as a central excavation of bluish white colour. It persisted through the whole period of pregnancy (Plate I, Figs. 1 and 2).

The colour of the lutein tissue varied during the period of pregnancy; the youngest corpus encountered, related to an embryo 3 mm. long, was of reddish orange colour. In the corpus related to a fœtus of 3.3 cm. long, the colour shaded into orange brown. In the fœtus 20 cm.-40 cm. long, the colour changed to reddish brown. In the middle and later periods of pregnancy the deep reddish brown colour gradually got lighter and persisted till term. The youngest corpus obtained measured 18 mm. and 15 mm. in longitudinal and transverse diameters, respectively. The size of the corpus related to fœtus of 3.3 cm. long increased to 20 and 17 mm. long in both dimensions. The average measurements attained during the period of pregnancy were 22 and 16 mm. long in both dimensions, and the largest

corpus obtained measured 30 and 20 mm. in longitudinal and transverse diameters, respectively. The average weight of the corpus till term was 4 gm., and the largest weighed 7.5 gm. However, the size, shape and position of the corpus during pregnancy were retained till term.

In case of twin corpora, the size of each corpus is smaller than the size of the corresponding single corpus.

Well-developed blood vessels were seen ramifying on the surface of the thecal layer.

Deformity of the ovary was noticed when the corpus was attached to its surfaces; the surfaces pulled downwards and as a result the free ventral border was raised. When the corpus was attached to the pole of the ovary the long axis of the latter changed its direction.

The presence of twin corpora lutea attached to the same ovary was of frequent occurrence; the ratio reached 20 per cent. The ratio of two corpora of equal size each attached to one ovary of the same animal was 3 per cent. In one instance three corpora of different sizes were present in the same ovary. Their measurements were as follows :—

Longitudinal diameters	...	...	20, 20, & 15 mm.
Transverse diameters	...	...	15, 13, & 13 mm.

In another case, the right ovary contained two corpora, measuring 17 and 15 mm. longitudinally and 10 mm. each transversely; the left ovary contained one corpus of 19 and 15 mm. in both dimensions.

Only one fœtus was present in the uterus of each specimen containing double or triple corpora.

On one occasion two fœtuses were present in the left horn with twin corpora attached to the corresponding ovary. The two fœtuses were equal in size, measuring 3.3 cm. long each, and each respective corpus measured 20 and 17 mm. in both dimensions.

According to the before-mentioned observations, the ripening and rupturing of two graafian follicles simultaneously is not unusual in the camel. The presence of double corpora with a single fœtus denotes the perishing of the other ovum early or the developmental failure of the embryo later.

It is interesting to notice that the left ovary was the more active in the production of ova than the right one. The larger follicles were seen in the early period of pregnancy only.

Regression of the Corpus Luteum

Macroscopic Character.—The morphology of the regressing corpus luteum was studied in 90 cases, five of which had a known history. The rest had been studied according to the size. The following three specimens were obtained after normal delivery :—

1. The animal was slaughtered on the fourth day after delivery. The corpus was firm and, unlike that of pregnancy, did not bulge nor did its capsule retract on sectioning. The colour was light brown and the central cavity

was a well-defined bluish white circular area; it measured 20 and 18 mm. in both dimensions.

2. The animal was slaughtered on the eighth day after delivery; the corpus was hard and measured 21 and 17 mm. in both dimensions. On section it was of brown colour, central cavity was defined.
3. The animal suckled its young for 30 days and was slaughtered on the 31st day. Two corpora were present; one was greyish white, hard and spherical in form, measuring 19 and 15 mm. in both dimensions. On section the capsular layer was thickened 1 mm. and the central cavity was well defined. The second was blackish grey, tense and oval in shape. On section soft blackish brown material bulged out and the rest was a pedunclated head-like part containing hair.

Microscopic examination proved that it was a dermoid corpus. A second one was obtained from a case of unknown history. The following specimens were obtained from aborted animals:—

4. The animal was slaughtered after 24 hours. The corpus resembled that of pregnancy and measured 17 and 13 mm. in both dimensions.
5. The animal was slaughtered after four days. The corpus was slightly firmer than that of the first specimen. On section the colour was also darkish; the ovary and the graafian follicles were dark red.

From the before-mentioned observations and those obtained from other specimens of uncertain history, the corpus luteum of the camel was found to change in consistency from a soft flappy nature to a hard one in about a week after birth or abortion. Although the corpus was gradually decreasing in size, it stood over the ovary's surface or border for a long time as a hard laterally compressed sphere of greyish colour. The oldest ones were seen as greyish white or yellowish white hard, button-like elevations on the usual points of attachment, of equal dimensions, 5 mm., in both directions, mostly embedded in the cortex. It was noticed that the regressing corpus decreased first in the transverse and then in the longitudinal dimensions, respectively and alternately.

On cross section, the corpora of less than 14 mm. long changed from brown to cocoa colour. When the corpora reached 7 mm. long their central cavities began to disappear. The white colour of the corpus albicans was seen only in some of those measuring 5 mm. The thecal capsule reached in some specimens about 3 mm. in thickness.

Microscopic Character.—Paraffin method and freezing microtome (in fresh specimens) were used.

Stains: Hæmatoxylin eosin, van Gieson's, Mallory's and osmic acid (fresh specimens).

In the corpus related to the embryo of 3 mm. long, the lutein cells were large with large round nuclei. The cells were not well defined due to the unstained periphery; the cytoplasm was vacuolated. Other larger vacuoles contained spherules, having the same colour as that of the cytoplasm, but differed by being refractile. (In fresh specimens the cells were oval.) The lutein cells were not supported directly by the connective tissue fibrils, which were found to

surround groups of the lutein cells in a basin-like manner. These groups of cells were not yet arranged in well-defined rows, as in older corpora. The cytoplasm took the red, brown and orange colours when stained with hæmatoxylin eosin, van Gieson's and Mallory's, respectively.

In the corpus related to the fœtus of 3 cm. long, the cells became larger with a less well-defined periphery; they had an elongated oval contour and were now arranged in well-defined rows separated by septa of connective tissue. The spaces between the septa were triangular on section. The apices were pointing towards the central plug. The before-mentioned spherules became larger. The nuclei were occupying various positions in the cells.

In the corpus related to the fœtus of 61 cm. long the cells now had a foamy appearance, and well-defined elongated oval wall with faintly stained nuclei. The connective tissue trabeculæ increased in number.

Regressing Corpus.—Three days after birth the capsule increased in thickness and each individual lutein cell was surrounded by connective tissue fibres.

Thirty days after delivery: the lutein cells were mostly degenerated; the nuclei were aggregated, forming spotted pools among the connective tissue fibres. In older corpora; the theca externa was changed into dense connective fibrous tissue.

Position of the Fœtus in the Uterus

It is interesting to notice that in all the specimens examined the fœtus occupied the left horn and partly the body of the uterus. No fœtus was encountered in the right horn during this work.

Examination of several non-pregnant uteri in different stages of involution revealed that the left horn was larger than the right one.

According to the above observations, the left horn pregnancy seems to be usual in the camel.

The longest fœtus encountered measured about 119 cm. long.

The shortest newly-born calf measured 104 cm. long and the longest was 122 cm. long. The average of 20 newly-born calves was 116 cm. long.

The duration of pregnancy according to Leese (1927) is 12 months, and according to Asdell (1946) 406 days.

Summary

The ovaries of one hundred and fifty Sudanese female camels were investigated *in situ* in the slaughter-houses of Cairo and Embaba and then afterwards removed for further examination with their corpora lutee. Sixty ovaries were of pregnant females and ninety were of non-pregnant females, but contained corpora lutei in different stages of regression. The results obtained from this study were as follow :—

1. The ovaries of the camels examined had no ovulation fossa and they were situated in their ovarian bursæ.
2. There was no attachment between the fimbriæ and the ovary.

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3. The graafian follicles were clear translucent spheres without apparent stigmas and the greater part of their bulk protruded over the ovary's surface. They were attached to the free ventral border of the ovary, usually near the poles.
4. Microscopic examination of the camel's ovaries revealed the same findings as those of most domesticated animals.
5. During pregnancy, the corpus luteum was a soft, flabby, laterally compressed sphere protruding wholly from the ovary's surface and it retained its size, weight, shape and position but changed its colour.
6. Twin corpora on one and the same ovary with a single fœtus in the uterus were of frequent occurrence.
7. The left ovary was more active than the right in the production of ova; left horn pregnancy was usual.
8. Microscopic examination of the corpus during pregnancy revealed gradual decrease of lipoids and fats in the lutein cells and increase of connective tissue elements in the corpus as pregnancy advances.
9. The corpus luteum changed into a hard, laterally compressed sphere in about a week after birth or abortion and the regressing corpus gradually decreased in dimensions, first transversely then longitudinally, alternately.
10. The degeneration of the lutein cells in the regressing corpus appeared to be due to the pressure of the gradually thickened thecal capsule and the invasion of fibrous connective tissue surrounding each individual cell cutting its blood supply.
11. Degeneration of the corpus into dermoid was demonstrated.

Acknowledgments

I wish to express my deep gratitude to Professor ElSayed Fouad, M.V.Sc., F.R.C.V.S.(Liverpool), the Dean of the Veterinary College and his assistant, M. R. El Hindawy, M.V.Sc., for allowing the histological part of this work to be done in their laboratory, as well as A. H. Mahmoud, M.V.Sc.(Liverpool), for his sound criticism.

Thanks are also given to N. Georgi, chief of Department of Anatomy, for his encouragement.

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(4) J. Hammond: "The Physiology of the Reproduction of the Cow," Cambridge University Press, Fetter Lane, London, 1927.

The author also submitted for publication a statistical protocol amounting to eight pages of MSS. It deals in a descriptive manner with the 150 camel ovaries which form the basic matter of this paper. Space and paper shortage prevent publication.—Ed.

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EXPLANATION OF THE PLATES

O: Ovary. C: Corpus luteum. P: Central plug or cavity.
H: Hilus. S: Stroma.

FIG. 1

(1) Longitudinal section in the ovary and oval corpus related to a fœtus of 3 cm. long The central plug is still membranous-like in appearance.
(2) Corpus related to a fœtus of 18 cm. long, showing lobulation through the still translucent thecal capsule.
(3) The pedunculated part of the dermoid corpus.
(4) Ovaries containing twin corpora.
(5) Regressing corpus (three days after delivery).

The rest of the photos are some specimens of corpora lutea of pregnancy, attached to the ovaries, some are long-sectioned to show the circular contour and central plug.

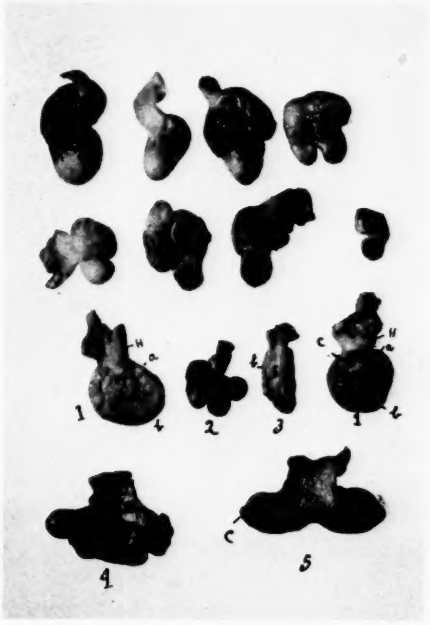

FIG. 2

(1) Ovary of camel showing the hilus (H), free ventral border (B) and the attached border (A).
(2) Ovary of sow showing the globular lobules.
(3) Cross section of camel's ovary showing the uniformly arranged (B) lobules (cortex) around the stroma (S).
(4) Sow's ovary, and (5) Camel's ovary, long-sectioned.

The rest of the photos are regressing corpora. Observe the thick capsule and the central plug in the long-sectioned ones; also the disappearance of the central cavity in the smallest (oldest).

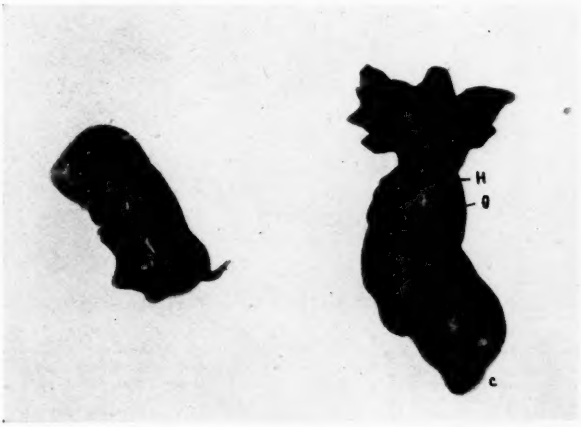

FIG. 3

Showing a fœtus of 3 cm. long and the oval corpus related to it. Observe the change in direction of the long axis of both ovary and hilus compared with the normal. The photo is somewhat enlarged.

PLATE I. (Article by Tayes.)

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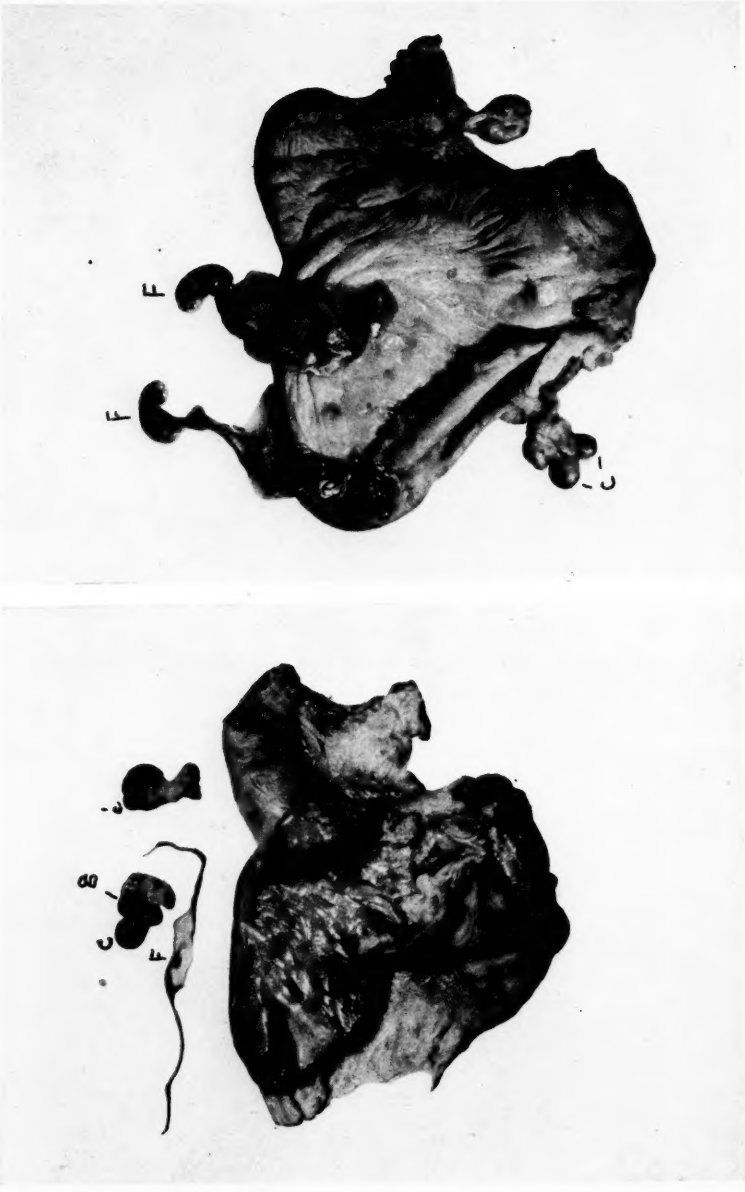

FIGS. 1 and 2

Opened uteri showing that a left horn pregnancy is usual in the camel. (1) showing an embryo of 3 mm. long, (F) in its fœtal membranes, corpus luteum related to it (C) and large graafian follicle (G) attached to the left ovary. The right ovary contains a regressing corpus. (2) Showing two fœtuses in the left horn and twin corpora lutei attached to the left ovary.

PLATE II. (Article by Tayes.)

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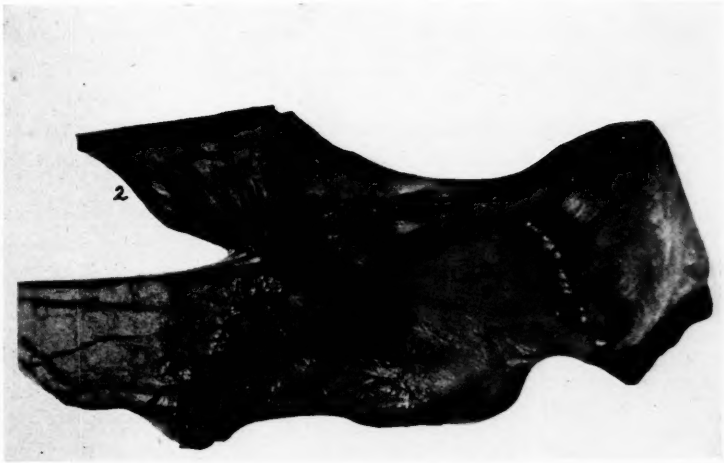


FIG. 1
Showing the ovary of a young female turned out of its bursa. (1) Ovary. (2) Bursa. (3) Hilus. (4) Ovarian ligament. (5) Meso-ovarian. (6) Fallopian tube. (7) Cornua.

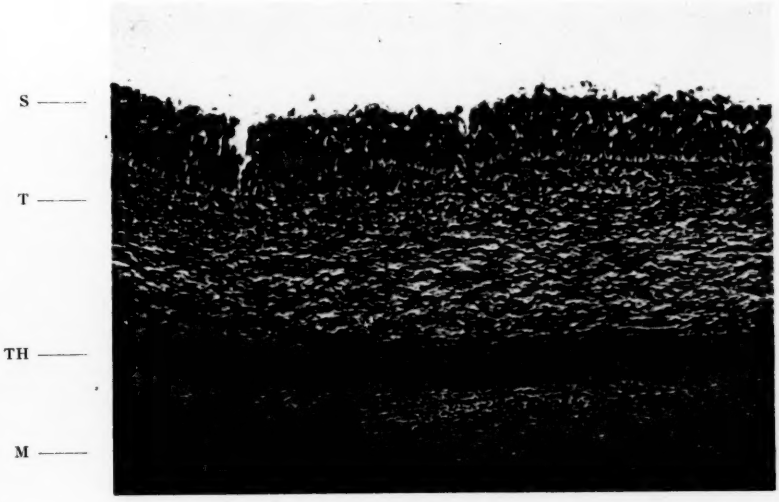
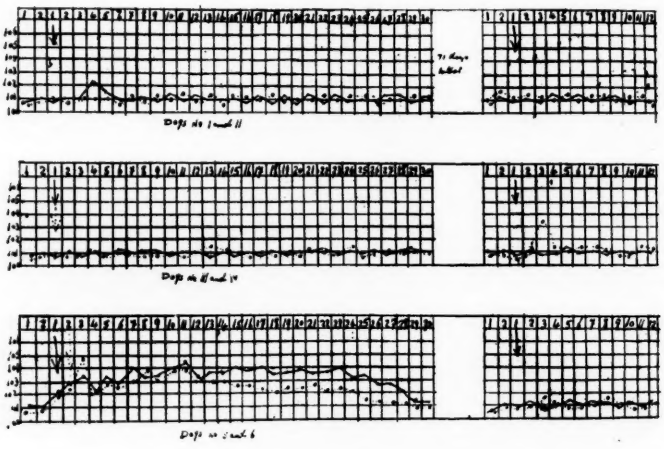


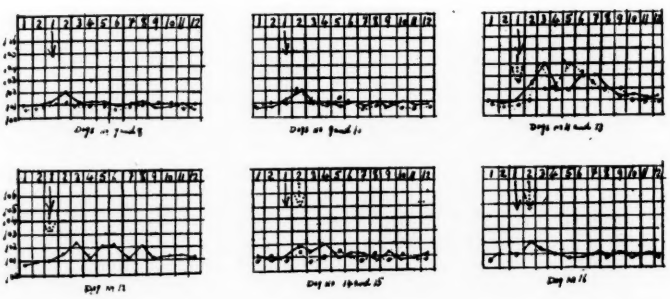
FIG. 2
Section of a moderately large graafian follicle (I.C.M.) (S) Stratum granulosum. (T) Theca interna. (TH) Theca externa. (M) Muscle layer.

PLATE III. (Article by Tayes.)

Experiment No. 1.



Experiment No. 2.



↓ = day of virus inoculation.

↓ = „ „ serum „

PLATE IV. (Article by N. H. Bastawy and G. Saleb.)

CANINE DISTEMPER IN EGYPT

By NASHED HELMY BASTAWY, M.V.Sc., and GUIRGUIS SALEB, B.V.Sc.

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ALTHOUGH distemper has long been known clinically to veterinarians in Egypt, hardly anything has been placed on record regarding either its prevalence or its incidence and severity among the dog population, whereas in Great Britain and other Western countries distemper is well known as the commonest scourge of dogs, affecting with particular severity young dogs.

In other countries—as, for example, India—experienced observers are in some doubt as to whether or not true distemper exists in these territories. Indeed, the complex of dog diseases varies enormously as between one country and another. While diseases such as tick-borne fevers are almost unknown in Britain, they are extremely common and largely dominate the picture in Eastern countries. As will be mentioned later, Egypt forms "a half-way house" between these opposite extremes.

Until recently, distemper was diagnosed everywhere on the basis of the clinical symptoms and post-mortem findings. In the countries in which it was the most prevalent dog disease, there is little doubt that in most cases the diagnosis was, on the whole, accurate.

It would be, however, decreasingly inaccurate in measure as other diseases prevail in a territory which call for some degree of skill in differential diagnosis. The time has come when, in truth, a disease can be said definitely to bear the label "distemper" only when a correct ætiological diagnosis has been made. In other words, in suspected cases when there is a grave doubt regarding the diagnosis, either the virus of distemper itself must be demonstrated or else immunological tests must be carried out to demonstrate that dogs recovered from the suspected disease had become immune to the actual virus of distemper. With the resources at our command here in Egypt, it would have been difficult to carry out the former kind of test, whereas it is always easy at the present time to carry out the latter.

Two experiments are summarised below which show, first, that young dogs in Egypt are frequently resistant to the virus, presumably after recovery from an attack that has passed unobserved. Secondly, some dogs, nevertheless, remain fully susceptible and are liable to contract the disease late in life. The tests were in large part carried out to determine whether or not genuine anti-distemper prophylactics as imported by air from England could be reliably used to immunise dogs in Egypt. The results show that this can be done.

Experiment No. 1

(*See Plate IV*)

Six dogs of uncertain age but reputed to be between six months and one year old, were kept in separate kennels in the infirmary for some weeks before the

experiment and divided into three groups of two each: namely, Group 1, to be inoculated with virus only (dogs 1, 2); Group 2, with virus and serum simultaneously (dogs 3, 4); and Group 3, with virus and then serum after 24 hours (dogs 5, 6). The virus and serum arrived by air on cabled request to Burroughs Welcome & Co., Ltd.; virus series were YCV 887, dated January 27, 1947; serum, Q 1981C, dated January 13, 1947. After arrival, the materials were kept in the refrigerator until the date of virus inoculation on February 12, 1947.

As will be seen from the result, only two dogs reacted—namely, the two that were inoculated with virus and serum 24 hours later. This was contrary to expectations. As it was suspected that the virus in some of the ampoules had become inert at the time of inoculation, a further consignment of virus and serum was ordered by cable. The virus from all the ampoules were pooled immediately before inoculation, so as to ensure uniformity in virus test.

Experiment No. 2

(*See Plate IV*)

Ten puppies, divided into three groups, as above: four were inoculated with virus alone (namely, 7, 8, 9, 10); three with virus and serum simultaneously (namely, 11, 12, 13); and three with virus followed by serum 24 hours later (namely, 14, 15, 16).

All six dogs of the preceding experiment were inoculated at the same time with the pooled virus alone to test their immunity. The materials (virus YCV 92G, dated April 14, 1947; and serum Q 1981C, dated January 13, 1947) arrived by air on April 14 and was kept in the refrigerator until April 23.

As will be seen from the charts, only two of the dogs in the second experiment reacted (namely, Nos. 11 and 13), inoculated with virus and serum simultaneously.

None of the six dogs surviving from the first experiment gave any distinct reaction.

The reactions in the two dogs (5 and 6) in the first experiment and the two dogs (11 and 13) in the second experiment must, therefore, be regarded as fortuitous. In other words, four only of 16 dogs proved to be susceptible to inoculation with the virus of distemper, the remaining 12 being immune.

The reactions to the virus—curbed as they must have been by the serum inoculations—although they remained febrile only in character, were sufficiently conspicuous in themselves and were so different from the uneventful temperature charts of the remainder as to present a sharp-cut differentiation between the dogs which were actually susceptible and those which were immune.

The numbers, of course, are far too small to warrant any general conclusion from this small sample, which, as they stand, would imply that nearly 25 per cent. of the ordinary dogs in Egypt remain susceptible to distemper when they reach about a year in age.

That this presumption has some foundation is borne out by the experience of one of us (N.H.B.) in his clinical practice extending over 13 years, in which several cases from time to time have come under his observation of what appeared

to be typical distemper in aged dogs. It is realised that great care must be taken in Egypt in diagnosing distemper because of the prevalence of other febrile diseases such as the tick-borne fevers (*Babesia canis* and *Piroplasma pattoni* infections) with which distemper may sometimes be confused.

The records of three representative cases are here summarised:—

Case No. 1.—On April 2, 1947, a crossbred bitch, mainly fox terrier, 11 years old, showed on admission mild febrile symptoms (103° F.); she was kept under observation and given febrifuges; four days later she appeared improved, with regained appetite, and moved about freely. The temperature, however, never dropped below 102° F. Treatment continued for another five days but no improvement took place; she showed some constipation with dark greenish fæces, highly offensive in odour, for which laxatives and enemata were prescribed. The temperature again began to rise to between 103° and 104° F. Fifteen days after admission, the intestinal disturbance got worse and diarrhœa set in, which persisted in spite of treatment. Twenty-seven days after admission, the animal showed catarrhal rhinitis and conjunctival congestion, temperature 104° F., rapid respiration and full, bounding pulse.

Thirty-one days after admission, pneumonia supervened and two days later the typical late distemper picture was presented, namely, lack of co-ordination of the limbs, with fits, which became progressively more severe. Death occurred four days after the onset of the nervous symptoms.

It is interesting in this case that distemper was not suspected until rhinitis and pneumonia appeared.

Case No. 2 *and* 3.—Approximately one week after the death of the above case, its owner returned to my clinic with two other dogs, again showing fever (104° F.), pustules on the abdomen, and acute purulent conjunctivitis.

These dogs were four and nine years old, respectively. Both (and especially the nine years old dog) showed marked irritability and nervous tension.

An opinion on these cases that they were indistinguishable from distemper was given by Mr. Stewart Watson, M.R.C.V.S., Director, Brooke's Memorial Hospital for Animals, Cairo.

After sulphonamide treatment, the catarrhal symptoms were suppressed. Corneal ulceration appeared in the nine-years-old dog four to five days after admission. Small doses of luminal (½ grain) twice daily were prescribed. Although no fits supervened, chorea appeared in the four-years-old dog, affecting the right shoulder 22 days after admission.

The nervous derangements got progressively worse in the four-years-old dog and after another week this animal developed paralysis in the hind limbs with intense irritability and died three days after the first appearance of these symptoms. The acute nervous symptoms which also appeared in the nine-years-old dog subsided and the animal appeared to return to normal 25 days after the first rise of temperature.

Summary and Conclusions

Canine distemper occurs in Egypt to such an extent that a large proportion,

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perhaps well over 50 per cent., of the dogs which survive to middle age have passed through an attack and are immune. A considerable proportion, however, do not contract the infection during early life and may contract it later, even in late life, with fatal results.

It is concluded, therefore, that it would be a wise precaution to immunise valuable dogs imported from England into Egypt against distemper before arrival so as not to run the considerable risk after arrival of contracting distemper.

Other infectious diseases, however, loom largely in the picture which are unfamiliar to the owner in England, especially the tick-borne fevers, for which careful watch has to be made in Egypt, so that the dogs are treated immediately they exhibit symptoms with the now well-known specific chemotherapeutic agents (trypanblue, pirevan, etc., in cases of *B. canis* infection, or repeated dosage with arsenicals, such as arrhenal, in cases of *P. pattoni* infection).

A brief review of the commoner dog diseases encountered in a city clinic in Egypt is under preparation by one of us (N.H.B.) so as to serve as a guide to both dog owners and veterinarians in regard to the precautions that need to be taken.

Acknowledgment

We acknowledge the help given to us in the direction of this work and writing this paper by J. T. Edwards, Visiting Professor and Temporary Dean of the Faculty.

The assistance given by A. R. El Affify, Hospital Assistant, is also gratefully acknowledged.

ON COMBATING OF TUBERCULOSIS AMONG DOMESTIC ANIMALS

Problems Concerning the Avian Infections*

By N. PLUM

In 1937 only 26.5 per cent. of the cattle herds in Denmark were found to be free from bovine tuberculosis. In 1946 this percentage had increased to 93.9 per cent. This result was obtained by a systematic campaign against bovine tuberculosis based on the intracutaneous tuberculin tests with bovine tuberculin, comparative double tests being employed to detect the animals reacting to the bovine tuberculin on account of infection with avian tubercle bacilli or, possibly, paratubercle bacilli.

Authors in other countries have wondered why, in Denmark, we look upon cattle with avian infection as being healthy. This standpoint is correct, however, hygienically, as destruction of such animals would be unreasonable. Furthermore,

* Read at the Fourth International Congress of Microbiology, Copenhagen, 1947.

at any rate in Denmark, it would have been impracticable to carry through the campaign against tuberculosis among the cattle if animals infected with the avian type—which often, as is well known, show no macroscopic changes whatever—had been considered to be tuberculous.

In our country we still have to eradicate avian tuberculosis. Even though this form of tuberculosis has been considered to be harmless to man, its eradication is still an important matter. Avian tuberculosis means not only a considerable financial loss to the poultry industry, but it also causes a great deal of trouble, waste of time and expense, and gives rise to complications in the tuberculin tests on the cattle. Avian tuberculosis will always be a danger because of the potential menace of bovine tuberculosis arising through spontaneous mutations taking place in the organisms—in this case from the avian to the bovine type.

Eradication of tuberculosis in fowls appears, however, to give rise to some difficulty. The rural population in general is not very interested in the matter, and even though tuberculous fowls are kept in wired pens, the infection may be spread from them by carriers.

That this must be the case was soon realised, and thus our attention was attracted to the aspects of avian tuberculosis in animals other than fowls.

The significance of avian tuberculosis in cattle and swine is well known, and we know that the organs of these animals may convey the infection to other animals. But this does not explain the entire question about the spreading of the infection.

It is well known that *pheasants* and *pigeons* are liable to tuberculosis and are able to transmit the infection. As to *sparrows*, our investigations have shown that these birds appear to be but slightly susceptible to spontaneous infection with avian tubercle bacilli. Still, if the infection takes, it will often be widespread in the flocks nesting round the farms, and cultures from such infected flocks may show growth of tubercle bacilli from a great number of apparently healthy birds, whereas only a few of the flocks show macroscopic lesions of tuberculosis.

In the case of *rats*, the matter is different. These animals are very resistant to infection, macroscopic tuberculosis being very seldom encountered among them. Rats are exposed to intense infection—e.g., when living in a tuberculous hen-house — may harbour tubercle bacilli in the organs without presenting any demonstrable pathological changes other than a moderate enlargement of lymph nodes with large-cell hyperplasia. Under these circumstances it appears as if the percentage of infection in the rats may rise even to about 100 per cent.

Gulls have attracted our attention in particular, and we have examined a considerable number of different species. Thus we have been able to show that pure cultures of tubercle bacilli may be obtained from about 4 per cent. of these birds, while only a few of them showed any macroscopic changes.

A further account of investigations concerning the aspects of avian tuberculosis in the animals mentioned, and in various wild birds, will be found in *Skandinavisk Veterinärtidsskrift*, 1942, p. 465.

As our knowledge concerning the infection of various animals with avian tuberculosis still is defective on several points, in the Danish State Serum Laboratory we have carried out a fairly extensive experiment in which we have tried to reproduce natural transmission of the infection as far as possible.

In some respects this experiment resembles the one described by A. F. Schalk, *J.A.V.M., 72; New Series V:* 25, 1928.

A fairly large flock, about 200, hens with pronounced tuberculosis were placed in a spacious pen, and each year 200 chickens were added in order to maintain the size of the flock. The experiment lasted four years and during this period the following animals were admitted to the pen: 2 *horses*, 10 head of *cattle*, a flock of *sheep*, *goats* and *swine*, besides *geese*, *ducks*, *turkeys*, *pheasants* and *wild ducks*.

The *turkeys* and *pheasants* were attacked by tuberculosis, so that the stock of these birds was soon reduced. The *wild ducks* appeared not to become ill at all, but tubercle bacilli could be obtained in pure culture from their organs.

As to the *ducks*, *geese* and *chickens*, we had some interesting experiences. *Goslings*, *ducklings* and *chickens* were placed in the pen as soon as they were big enough to get along by themselves.

Chickens admitted to the pen in June commenced to die of tuberculosis round New Year. In order to follow the course of the lesion, some of these animals were killed in the autumn, and in November and December growths of tubercle bacilli were obtained in pure culture from their organs. Strange to say, however, *goslings* and *ducklings* admitted to the pen at the same time presented the same features one month earlier, and thus we were able to ascertain the apparently paradoxical fact that in cultures from the organs the growth of avian tubercle bacilli could be demonstrated one month earlier in *geese* and *ducks* than in *chickens*, although—in contrast to the *chickens*—among the *geese* and *ducks* a state of generalised tuberculosis was demonstrated only in one instance, and that was in a *duck*.

Through a number of years the avian infection in *swine* has attracted our attention in a particular degree. So in order to make sure that the tuberculous fowls were infective to swine we purchased fowls from four farms from which we knew with certainty that swine suffering from generalised avian tuberculosis had been sent to the slaughter-house. Even though we thus had ensured that tubercle bacilli virulent to swine actually were present in large amounts among the fowls, the outcome of the experiment was rather negative.

To begin with, the pigs were placed in the pen when they were about four weeks old; and here they stayed until they were sent to the slaughter-house. Thus the pigs were given an ample opportunity throughout their growth period to ingest avian tubercle bacilli, as they ravenously devoured the dead fowls. At their slaughter these swine showed only a few lesions of tuberculosis in cervical or mesenteric lymph nodes but no generalised tuberculosis. We then let a sow live in a box in the hen-house itself, where she

farrowed several times so that the suckling pigs were highly exposed to tuberculous infection from the first day of life.

This made no difference to the results: generalised tuberculosis was not demonstrated in any of the pigs.

As to the outcome of the experiments in *calves, goats* and *sheep,* only in cattle could any visible tuberculous lesions be demonstrated, and then only in very few lymph glands of the digestive tract, notwithstanding the fact that they all gave positive tuberculin reaction. The *horses* remained in good health even though they became tuberculin-positive.

Foxes.—Four young foxes were placed in a secure cage and were mainly fed on tuberculous fowls. None of them became ill. After an experimental period of nine months the foxes were killed, and all the organs were found to be normal, whereas growth of avian tubercle bacilli could be obtained in cultures from the lymph glands of the intestinal tract.

The experiments here described gave us no information as to why avian tuberculosis at times may be highly virulent to some animals—e.g., swine and ox. So when now and then we find individuals of these species attacked by generalised tuberculosis, other factors, as yet unknown to us, must play a rôle in the appearance of this phenomenon.

Summary

In 1937 only 26.5 per cent. of the cattle herds examined in Denmark were found to be free from bovine tuberculosis. In 1946 this percentage had increased to 93.9 per cent. of practically all herds in the country.

This result has been obtained on the basis of intracutaneous tuberculin tests with bovine tuberculin, in which comparative double tests are employed to demonstrate the animals reacting on account of infection with avian tubercle bacilli.

It now remains to eradicate the avian tuberculosis, which not only causes difficulties in the tuberculin tests, but also causes a considerable financial loss.

Eradication of avian tuberculosis is rendered difficult by the fact that many apparently healthy animals harbour living avian tubercle bacilli in their organs.

Such concealed infections have been demonstrated in several species of birds—e.g., gull, duck, goose—and some mammalian species as, for instance, swine, sheep, ox, fox and rats. Presumably such infections are demonstrable in several other species. There can be no doubt, however, that by rational combating of avian tuberculosis in fowls it will be possible to eradicate this infection also in other species—just as eradication of tuberculosis among cattle has led to the disappearance of the bovine tuberculosis in other species.

This question is of interest also in a much wider sense, as it is reasonable to expect that avian strains may undergo mutation, so that gradually they may acquire bovine virulence.

An experiment in the field, carried out in order to investigate the virulence of avian tuberculosis to horse, ox, sheep, goat, swine and fox, gave a negative result with regard to the demonstration of generalised tuberculous infection in these animals.

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STUDIES ON THE BLOOD OF DOGS: III.—Hæmatological Findings in some Physiological States—(*a*) Pregnancy; (*b*) Post-Partum and Lactation

By M. R. EL HINDAWY, M.V.Sc.(Cairo)
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(*a*) The Blood Picture in Pregnancy

In the course of this study an opportunity was presented to observe the hæmatological changes in 24 apparently normal bitches during early and late periods of gestation, eight being in the early period and 16 in the late period of gestation. One case was examined just before labour and again after giving birth to her litter. All animals were in good health except that all had either mild or severe intestinal parasitic infestation.

Results

Blood Picture	Early Pregnancy			Late Pregnancy		
	Min.	Max.	Aver.	Min.	Max.	Aver.
R.B.Cs. ...	3,300,000	5,720,000	5,150,000	5,150,000	6,920,000	5,810,000
W.B.Cs. ...	8,600	19,400	14,925	9,600	18,800	14,415
Hb. % ...	47	55	52	51	70	59
Hb. g. ...	8.1	9.4	8.8	8.7	12	10
C.I. ...	0.43	0.75	0.51	0.42	0.62	0.51
Ret. ...	1.2	4.0	2.6	0.2	4.0	1.5
Bas. % ...	0.0	0.7	0.09	0.0	1.0	0.1
Eos. % ...	4.0	8.3	6.8	0.4	24.0	7.7
Myel. % ...	0.0	0.0	0.0	0.0	0.0	0.0
Juv. % ...	0.0	4.7	1.46	0.0	1.6	0.2
Stab. % ...	2.8	9.0	5.5	2.0	12.0	5.8
Seg. % ...	45.0	73.0	58.6	45.7	80.8	64.6
Neut. % ...	48.3	85.0	65.3	47.0	84.4	70.6
Lym. % ...	2.4	34.0	12.0	5.6	27.0	12.6
Mon. % ...	2.7	25.0	12.8	4.4	19.2	8.9

Discussion

There were found no constant changes in the red cell count during pregnancy, which seemed to lower the count only for a short time. In some cases, the red cells showed moderate anisocytosis and poikilocytosis and well-marked hypochromasia. The hæmoglobin content was usually lower than normal. The colour index was below unity and in some cases as low as 0.40. A mild anæmia of the secondary type with low colour index developed in the early stages and sometimes this became severe.

Spielgelberg and Gescheidler (1872) and Nasse (1876) reported that in bitches

the blood was more dilute during the latter half of pregnancy. Spiegelberg and Gescheidler did not believe this to be significant, because they found the percentage of hæmoglobin in non-pregnant and pregnant bitches to be equal. Schmidt and his associates (1927) reported that a slight hydræmia occurred during the last ten days of pregnancy in bitches. They believed that the degree of hydræmia was significant, but they reported the results of only three experiments. Lyon (1929) and Fullerton (1936) believed that marked anæmia of pregnancy was probably dependent upon the presence of pre-existing anæmia which was not necessarily dependent upon pregnancy *per se*. Bethell (1936) concluded from his studies that anæmia in pregnancy is commonly due to either pre-existing iron depletion or to an inadequate intake of protein of high biological value during gestation. Bussaberger, Cuthbert and Ivy (1939) concluded from their studies on the anæmia of pregnancy in normal and gasterectomised bitches, that the hypochromic anæmia of pregnancy is due either to a direct dietary deficiency or to a deficiency conditioned by gastric anacidity, hypoacidity or associated gastro-intestinal defect in the presence of the fœtal demand for blood-building material. Strauss and Castel (1932) believed that the early anæmia is due to hydræmia and not to be a "trauma anæmia." They explain later anæmia is due to the demands of the fœtus and to "dietary deficiencies conditioned by gastric anacidity of related gastro-intestinal disturbances." In his summary, Strauss stresses the following points to be of fundamental importance in regard to the etiology and treatment of anæmias of pregnancy :—

(a) The physiologic anæmia is due to hydræmia.

(b) Hypochromic anæmias are due to a dietary deficiency, to a deficiency caused by gastric anacidity or to the extra demands of the fœtus, and all are ameliorated by large doses of iron.

(c) Macrocytic anæmias are caused by a lack of the extrinsic factor in the diet and may be corrected by liver treatment or by liver treatment supplemented with iron.

(d) These anæmias may be prevented by dietary prophylaxis.

Leucocytosis is said to exist in pregnancy, but only slight leucocytosis was observed in the present study. This leucocytosis has been attributed to many factors, such as increased metabolic activity, the presence of absorbed foreign material from the fœtus, the cellular damage that may be going on in the liver and kidneys, although it should be pointed out that apparently the leucocytosis of the toxæmic states does not exceed that of the normal bitch. During the later weeks of pregnancy a moderate physiologic leucocytosis was observed in the cases under study. Some observers disagree with this statement but admit the occurrence of leucocytosis only in the primiparæ.

Burnett (1908) states that during the latter part of the period of pregnancy in women there is usually a moderate increase in the number of leucocytes. It is a mixed leucocytosis, the percentages remaining unchanged; the eosinophiles may, however, be increased. Szepeshelyi (1934), after studies on the blood picture of bitches during pregnancy, found that leucocytosis occurs only during the last few days of pregnancy and asserts that pregnancy could not be diagnosed by any

change in the blood picture. Burnett and Traum (1908) found leucocytosis in a bitch, reaching 23,000 at the time of parturition, then dropping to normal in less than three weeks. Piney (1931) is in agreement, and states that during pregnancy in women there are invariable changes in the number of red corpuscles and that leucocytosis is common and that high degrees of leucocytosis are common at the end of pregnancy.

In all our cases there was a very definite shift to the left of the nuclear index of the neutrophiles. Neutropenia with a relative eosinophilia of lower degree than that of helminthic eosinophilia was usual, but lymphocytes were decreased especially during the later cases of pregnancy. No significant change was observed in the monocytes.

Summary and Conclusions

(1) The blood picture of 24 normal bitches was observed in early and late stages of pregnancy.
(2) The red cell picture was indistinguishable from that of helminthic anæmia.
(3) There were marked morphological changes in the red blood cells.
(4) The hæmoglobin content was below normal.
(5) The colour index was below unity.
(6) There was an increase in the reticulocytes.
(7) Pregnancy in normal bitches causes a moderate anæmia of the secondary type.
(8) A moderate physiologic leucocytosis occurred.
(9) There was no significant change in the differential leucocyte count except a slight decrease in the lymphocytes with a slight increase in eosinophiles which may have been due to the intestinal parasites.
(10) In all cases there was a slight shift to the left in the nuclear index of the neutrophiles.
(11) The etiology of the anæmia of pregnancy has been discussed in the light of the findings reported by other workers.

(*b*) The Blood Picture in Post-Partum and Lactation

Thirteen of the bitches examined had just been taken away from their litters when they were admitted for experiment. They showed the usual post-partum signs and were in lactation, the teats being full of milk.

Discussion

The average number of red blood corpuscles and the percentage hæmoglobin content in these cases were distinctly below the average for normal and pregnant bitches. The result denotes that the anæmia of the puerperium was more marked than the anæmia of pregnancy, in almost every case. Kracke (1937) believes that parturition seems to lower the count for a short time. Burnett and Traum (1908) found that the count remained low in a bitch for two or more weeks after parturition. C. E. De Camp (1936) reports that early stages of lactation usually have

a low hæmoglobin content and decreased red cells figures, which often rise in the latter part of the lactation period. The reserve supply of hæmoglobin was gradually depleted during lactation which, if unduly prolonged, resulted in anæmia.

There was marked variation in size and shape of the red cells. Many normoblasts and reticulocytes were present. Although the white cell count was below that of normal or pregnant bitches, yet there was an increase in some of the cases. It seems that after labour is ended the count falls to normal within a few days providing complications do not arise.

Burnett (1908) states that after parturition the leucocytes gradually decrease, reaching the normal in four to fourteen days. Burnett and Traum found a leucocytosis reaching 23,000 in a bitch at the time of parturition, then dropping to normal in less than three weeks. Wells and Sutton (1915) state that counts just before and after parturition show an unusually low number of red blood cells which appear to increase as the puerperium advances.

Results

Blood Picture			Min.	Max.	Aver.
R.B.Cs.	...	...	3,240,000	5,890,000	4,780,000
W.B.Cs.	...	...	4,600	22,800	11,330
Hb.	%	...	43	75	54
Hb.	g.	...	7.5	12.8	9.2
C.I.	...	...	0.46	0.93	0.57
Ret.	%	...	0.2	4.0	1.5
Bas.	%	...	0.0	0.6	0.04
Eos.	%	...	2.0	30.0	9.4
Myel.	%	...	0.0	1.0	0.07
Juv.	%	...	0.0	3.0	1.2
Stab.	%	...	2.0	14.0	6.7
Seg.	%	...	35.0	77.4	58.4
Neutr.	%	...	53.0	84.4	66.8
Lym.	%	...	4.0	24.0	19.4
Mon.	%	...	2.8	24.0	8.2

Summary and Conclusions

The blood of thirteen normal bitches in lactation was examined:—

(1) The red cell count and hæmoglobin content showed a more marked decrease than in either pregnant or normal bitches.

(2) The blood picture was that of a secondary anæmia; it was more marked than in the anæmia of pregnancy. Sometimes this became severe. As a rule the picture always remained that of a secondary type of anæmia with a low colour index. Blood films showed normoblasts with anisocytosis, poikilocytosis in the red cells.

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(3) The white cell count was found to be either below or above the normal average but its mean was below normal.

(4) The differential leucocyte count showed marked lymphocytosis, a slight eosinophilia and a moderate decrease in monocytes.

(5) The Schilling index revealed an increase in the segmented forms of the neutrophiles.

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HYPERTONIC SALINE IN UMBILICAL HERNIA IN CALVES

By F. C. BHUYAN, G.B.V.C.
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In January, 1940, while I was in charge of the Veterinary Hospital at Silchar, I was called to attend a young calf belonging to the Deputy Commissioner, Cachar, with a (puffy) fluctuating swelling on the umbilicus. In size and shape it resembled a hen's egg.

History of the Case.

The owner got the calf and its mother from Halflong Hill, about 150 miles away from Silchar. The calf was 10 days old and was very sick on the train journey. The swelling was diagnosed as reducible umbilical hernia. Our usual treatment, i.e. pressure bandage with cork-plaster, was tried for a week but was of no avail. The owner was not willing to allow an operation and wanted to destroy the calf, but at my request agreed to a week's trial.

Treatment

After reducing the hernia, I injected 1 c.c. hypertonic saline near the edge of the umbilical ring and in 4 to 5 places. I used a fine hypodermic needle, taking particular care to avoid any injury to the intestines. To stimulate and hasten

constriction, a pressure bandage was applied. This treatment was continued for three days. Then an appreciable improvement in constriction of the ring was noticed. The treatment was continued up to the seventh day, when the whole ring was closed. A simple pressure bandage was put on for a few days more. I saw the case a year later and the umbilical orifice was firmly sealed.

A Second Case

On December 10, 1945, a new-born calf of mine developed umbilical hernia.

History of the Case.

The cow calved a healthy calf at night, in the standing position. The umbilical cord severed with violence too close to the umbilicus. This happened during my absence from home. On the seventh day I found the calf with a puffy, fluctuating swelling—size of a duck egg—at the umbilicus. It was umbilical hernia (reducible). The treatment described above was again applied and in ten days complete resolution was effected. The success of this method of treatment in two cases prompts this record in the hope that it may be of use to other surgeons.

REVIEW

Reminiscences of a Sporting Artist. By LIONEL EDWARDS. London: Putnam & Co., Ltd. Price: 25s. net.

LIONEL EDWARDS has justly earned fame as a man who can draw and paint real horses and real hounds that are a delight to the sportsman with an eye for shape, action and poise. On reading this book we can see that he is equally facile and true to life with the pen. If he had not been gifted to be an artist one can imagine that he would have graduated as a huntsman or to the seat of a coach in order to be with his idols, the horses. As it is, his artistic gifts have evidently been used in no small measure as a means to an end to supply the wherewithal to gratify his sporting instincts.

He was born into the golden days of the horse, and art and hunting were in his blood. He seems to have made time and opportunity to indulge his passion with packs in every part of the Kingdom and abroad. He has made friendship with all types and grades connected with the sport, indeed there would appear to be few men of renown with the sport that he has not met or about whom he has something to say.

His reminiscences are an epitome of the sport during the last 50 years or so. He has seen hunting made easy by the horse box, made dangerous by wire, he has witnessed the dictatorial powers and language of the older type of Master give place to more polite verbolism of the modern, yet one senses in his words a sigh for the past.

His book will educate and delight the reader, but even if this was not so, the 203 illustrations more than justify its acquisition.

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CORRESPONDENCE

The Editor, THE VETERINARY JOURNAL.

SIR,—Plans have been made for a Memorial to those of the Royal Veterinary College who gave their lives in the two world wars.

I should be grateful if through your columns I might ask your readers to send me the names of staff and students who died in the 1914-18 war. In this respect our records are incomplete, but otherwise we have the information we need.

Yours faithfully,
H. W. J. ADAMS,
Secretary.

Royal Veterinary College,
Bursar's Office,
Royal College Street, N.W.1.
May 7, 1948.

Publishers' Notices

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